PR-NET-OSM-011

MANAGEMENT OF WORK OR TESTING IN SUBSTATIONS WITH EXPOSED LIVE BUSBARS AND/OR GAS INSULATED APPARATUS

OPERATIONAL SAFETY MANUAL - SECTION 6.2

Scottish & Southern Electricity Networks

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1 Introduction

1.1 **SSEN-D** recognises its obligations to provide **Authorised Persons** and non-**Authorised Persons** safe access and working environments in exposed busbar or gas insulated substations.

1.2 This document defines the **Approved** procedure for the control of work or testing in exposed **Live** busbar or gas insulated substations owned and managed by **SSEN-D**. In particular, this procedure deals with the demarcation of safe zones of work.

1.3 Compliance with the following procedure **Shall** enable staff to work safely and reduce the risk of injury to themselves and their colleagues.

2 Scope

2.1 The scope of this document **Shall** be limited to persons who are required to work or test in exposed **Live** busbar or gas insulated substations (including **Switching** stations and cable compounds etc.) and who hold the appropriate competence and authorisation to carry out specified duties.

2.2 The procedures included herein have been developed to minimise incidents associated with human error by ensuring that:

- A consistent approach is maintained for the management of work in exposed busbar or gas insulated substations connected to the **System**, in particular the demarcation of safe zones of work
- At all times consideration is given to the operating characteristics of the **System** and the **Dangers** imposed

2.3 This document applies to substations energised at nominal **System** voltages up to and including 132kV. It gives further guidance to the safety precautions that should be taken when working in a demarcated work zone.

2.4 This document **Shall** be read in conjunction with Sections 4.4, 4.5 and Appendix A of the **OSR.**

3 References

The documents detailed in Table 3.1 - Scottish and Southern Electricity Networks Documents, and Table 3.2 - External Documents, should be used in conjunction with this document.

Table 3.1 - Scottish and Southern Electricity Networks Documents

Reference	Title
PR-NET-OSM-006	Distribution Operational Safety Rules 2022 – Operational Safety Manual – Section 1.1
PR-NET-OSM-028	Switching Terminology and Approved Abbreviations - Operational Safety Manual - Section 4.4
PR-NET-OSM-043	Access to Substations and Switching Sites - Operational Safety Manual – Section 6.1
PR-NET-SST-009	Reducing Gas Pressure to Work in SF6 Filled, GIS Switchgear - Maintenance Procedure
WI-NET-ENG-038	High Voltage Apparatus Decommissioning Procedure
WI-NET-OSM-002	Personal Protective Equipment and Workwear for Live Environments
TG-NET-OHL-002	Exclusion Zones - Working at Height - Safety Instruction
N/A	SSEN SHE Handbook (Held in Safety, Health and Wellbeing SharePoint Site)

Table 3.2 - External Documents

Reference	Title
ESQCR	Electricity Safety, Quality and Continuity Regulations 2002 (as amended)
CDM	Construction Design and Management Regulations 2015 (as amended)
HSE GS6	Health and Safety Executive Guidance Note GS6 Avoidance of danger from overhead electric power lines
ENA TS 41-24	Energy Networks Association Technical Specification 41-24 Guidelines for the Design, Installation, Testing and Maintenance of Main Earthing Systems in Substations
ENA ER G136	Energy Networks Association Engineering Recommendation G136 Vegetation management near electricity equipment – principles of good practice

4 Definitions

4.1 The words printed in bold text within this document are either headings or definitions. Definitions used within this **Approved** procedure are defined within the list presented immediately below, or within Section 2 of the **Operational Safety Rules (OSR**).

4.2 **Demarcated Zone**

A safe zone of work or testing area within an exposed **Live** busbar compound or section of gas insulated **Apparatus**, identified by a **Senior Authorised Person** and constructed in accordance with this **Approved** procedure.

4.3 **Long Object(s)**

Any tool or piece of equipment which by virtue of movement or improper use might infringe the Safety Distance.

4.4 **Operational Safety Rules (OSR)**

The **SSEN-D** Distribution set of rules, as read with related documents and procedures, that provide generic safe systems of work on the **System** therefore ensuring the health and safety of all who are liable to be affected by any **Danger** that might arise from the **System.**

5 General Responsibilities

5.1 Persons who are required to operate and undertake work on the **System**, **Shall** have a thorough understanding of the work and ensure on-site risks are suitably assessed and appropriate control measures put in place before, during and after all activities.

5.2 Persons **Shall** ensure that, at all times during the work (or associated testing), **General Safety** arrangements are maintained and that other work areas are not adversely affected by the activities for which they are responsible.

6 Authorisation

6.1 It **Shall** be the responsibility of the individual to ensure that any actions performed are within the bounds of their competency and authorisation level.

6.2 Competency and Authorisation certificates **Shall** be retained personally and be made available upon request.

7 Personal Protective Equipment

7.1 Persons who are required to work or carry out **Switching** in Grid and Primary substations **Shall** wear suitably **Approved** Personal Protective Equipment (PPE). Furthermore, where warning labels or labels that identify a particular hazard exist, additional and appropriate PPE **Shall** be worn.

7.2 As a minimum, PPE **Shall** meet the requirements of WI-NET-OSM-002.

8 General Requirements

8.1 All persons who may be concerned with work in exposed Live busbar or gas insulated substations **Shall** be trained in and be conversant with the treatment of electric shock.

8.2 As working environments are subject to change, work in exposed **Live** busbar or gas insulated substations **Shall** be regularly assessed for **Danger** and where necessary the appropriate control measures put in place before, during and after work activities.

8.3 Depending on the nature of the work, the appropriate level of supervision **Shall** be provided. To achieve safety from the **System**, a **Demarcated Zone Shall** be used to ensure clear boundaries are established between safe and potentially unsafe workplaces.

8.4 Work in exposed **Live** busbar or gas insulated substations typically takes place on a specific item of **Apparatus** under the control of a **Safety Document**, with adjacent **Apparatus** energised at the nominal **System** voltage. The **Senior Authorised Person** issuing the **Safety Document Shall** ensure that all persons working in the substation clearly understand what **Apparatus** they are to work on and also under which **Safety Document** they are to work.

8.5 **General Safety** precautions in relation to access and egress routes **Shall** be taken. These safety precautions **Shall** meet the requirements of PR-NET-OSM-043 Access to Substations and Switching Sites - Operational Safety Manual Section 6.1.

8.6 Within the bounds of their authorisation, persons who enter the exposed **Live** busbar or gas insulated substation **Shall** be responsible for maintaining the security of the premises during their visit. Additionally, persons **Shall** be responsible for the conduct of any **Working Party** under their control.

8.7 Where work on-site is governed by the Construction Design and Management Regulations (CDM) 2015 (as amended), persons accessing the exposed **Live** busbar or gas insulated substation **Shall** observe any requirements imposed including site inductions, safety briefs, engagement with the site Principal Contractor and submission of any paperwork associated with the management of risk.

9 Procedure

9.1 General

9.1.1 Persons who are required to undertake work in exposed **Live** busbar or gas insulated substations **Shall** be aware of the **Dangers** that might arise. The main **Dangers** include, electric shock, burns and serious injury arising from:

- Persons working on wrongly identified equipment
- Electric shock from direct and indirect contact with **Live Conductors**
- Inadvertently infringing a **Safety Distance**

- Inadvertent and uncontrolled release of stored energy from **Apparatus** and **Plant**
- Poor planning leading to a failure in the co-ordination of on-site work activities
- Failure to adequately control vehicle movement
- Personal asphyxiation and/or environmental damage due to release of insulating gas

NOTE: Prior to the receipt of a **Safety Document** the **SAP shall** take measures to satisfy the requirements of **OSR** 5.2, 5.6, etc with regard to remotely and automatically controlled equipment, spring charged or pressurised systems.

9.2 Risk Assessment

9.2.1 Where work on-site is governed by the **SSEN-D** Safe Management of Work Process (SMoW), persons accessing the exposed Live busbar or gas insulated substation **Shall,** where appropriate, submit paperwork associated with risk management and the control thereof.

9.2.2 In circumstances where there are specific arrangements on-site for compliance with the Construction Design and Management Regulations (CDM), persons accessing the site **Shall** comply with relevant on-site arrangements, unless dispensation has been granted under emergency circumstances.

9.2.3 Where work or testing is to be carried out in compounds with exposed Conductors, an 'Exposed Busbar Risk Assessment' **Shall** be completed (see Appendix A) before any work or testing commences under a **Safety Document**. The Exposed Busbar Risk Assessment **Shall** determine the most appropriate method for defining the limits of the work, taking into account the activities to be carried out.

9.2.4 Decommissioning work on Gas Insulated Switchgear (GIS) that requires access to the gas compartment, **Shall** be carried out with the **Apparatus** decommissioned in accordance with WI-NET-ENG-038 and confirmed through the issue of a decommissioning certificate. Where decommissioning is not required, work on GIS **Apparatus Shall** be carried out following a risk assessment and valuation of findings, and demarcation of the **Apparatus** concerned.

9.3 Demarcation Equipment Stock Levels

9.3.1 Demarcation equipment **Shall** be made available at each exposed **Live** busbar substation. Typically, this will consist of independent support cones, barrier chains, warning notices and hazard labels of various sizes (see Appendix B). Minimum stock levels **Shall** be maintained to allow suitable and sufficient demarcation to be applied for the assets located on site.

9.3.2 Demarcation equipment **Shall** be securely stored on-site. Care **Shall** be taken to ensure stored equipment does not restrict access, present a hazard or compromise security.

9.4 General Use of Demarcation Equipment

9.4.1 A **Demarcated Zone** is a key control measure used to achieve safety from the **System** by ensuring clear boundaries between safe and potentially unsafe workplaces.

9.4.2 Demarcation equipment used, **Shall** observe and be manufactured in accordance with the standard colour scheme adopted. This colour scheme and use of associated warning notices and hazard labels **Shall** be representative of the **Safety Document** in force at the zone of work at any given time.

9.4.3 The decision to erect a **Demarcated Zone Shall** be the responsibility of the **Senior Authorised Person** attending site. Demarcation **Shall** be achieved using independently supported free standing equipment or permanent equipment in accordance with this **Approved** procedure. The **Demarcated Zone** may also include the use of a permanent fence or wall to form the zone boundary.

9.4.4 The combination of **Approved** cones and barrier chain equipment is not designed to be a physical barrier to stop intruders gaining access to the **Apparatus**, or to keep any member of the **Working Party** in the zone of work. The purpose is to display a marker or indicator for the limits of the zone of work.

9.4.5 Entry to the **Demarcated Zone** is only permitted by a member of a **Working Party** under the terms of the **Safety Document**.

9.4.6 No person **Shall** enter or exit a **Demarcated Zone** by crossing over or under any chain or barrier. The designated access point(s) **Shall** be used without exception.

9.5 Access and Egress

9.5.1 Where necessary to prevent **Danger**, the access and egress ways to and from the zone of work **Shall** be defined using temporary or permanent notices.

9.5.2 Although not a mandatory requirement, the use of laminated site plans with marked up access routes is encouraged. These should be posted in prominent positions throughout the site, for example at the substation main access gate and in the local control room.

9.5.3 High risk movements including the use of mobile **Plant** such as mobile elevated work platforms (MEWPS), excavators, cranes or open platform type vehicles carrying large, heavy or **Long Objects** require special consideration. The use and limits of operation of such equipment **Shall** be agreed by the attending **Senior Authorised Person** in accordance with Rule 4.5.5 of the **OSR**.

9.5.4 The necessity for any such access route **Shall** be justified as part of the 'Exposed Busbar Risk Assessment'. Consideration **Shall** be given to:

- The type of vehicles used
- The requirement for **Long Objects**
- The technical competence of the members of the **Working Party**
- The nature of the work being done and the complexities and sources of **Danger** along the specified access route
- The most appropriate access gate to be used; and
- Positioning of the **Demarcated Zone** access point to physically allow non-pedestrian access

9.5.5 Access and egress routes **Shall**, where reasonably practicable, avoid passing under **Live High Voltage Conductors**.

9.5.6 Mobile **Plant Shall** be connected to the substation **Earthing System** as soon as reasonably practicable.

9.5.7 The use of temporary height restriction systems is permitted. Where used, these systems **Shall** meet the requirements of HSE GS6. Height restriction systems **Shall** be erected in such a way that they comply with the Working and Access Clearances specified in the **OSR** to avoid **Danger**.

9.5.8 Height restriction systems **Shall** be durable, rigid, non-conducting and provide a highly visible proximity warning.

9.5.9 In periods of darkness and diminished daylight **Approved** illumination fittings **Shall** be used. Fittings **Shall** be sited at ground level projecting the light upwards towards the non-conductive height limiting chain (or bunting) and any exposed **Live High Voltage Conductor** that might be in the vicinity.

9.6 Approved Work Fence

9.6.1 Where the work to be carried out is by persons who have not been appointed in writing by **SSEN-D** or issued with appropriate keys, and where it is not appropriate to accompany the **Working Party** by an **Authorised Person**, the erection of an **Approved** work fence which allows direct access to an enclosed work area is permitted. Consideration **Shall** also be given to the enclosing of long-term construction works using **Approved** work fencing.

9.6.2 An Approved work fence **Shall** be a chain link or similar, not less than 1.2 metres high, attached to stable independent supports so that it forms a substantial barrier between the source of **Danger** and any safe area. By definition, a substantial barrier cannot reasonably be crossed without the use of ladders, dismantling tools, or crossing underneath it. The work fence **Shall** be fitted with appropriate warning signs throughout its length.

9.6.3 Where practicable, the work fence **Shall** be connected to the substation **Earth** system using **Earth Conductors** of an adequate size. In circumstances where this cannot be achieved, **Earthing Shall** meet the requirements of ENA TS 41-24.

9.6.4 At all times, consideration **Shall** be given to the substation earthing layout and other precautions such as the use of an insulated section.

9.6.5 The height of the work fence **Shall** be determined in light of the following considerations:

- Where a work fence is to be used as an external substation security fence and where the public have access to that fence, the requirements of the Electricity Safety, Quality and Continuity Regulations (ESQCR) **Shall** apply whereby the work fence **Shall** be 2.4 metres in height, secure, with notices and anti-climbing arrangements as necessary
- The presence of exposed **Live High Voltage Conductors** within the vicinity might restrict the height of the fence

9.7 Applied Demarcation when under the Control of a Permit-to-Work

9.7.1 The erection and dismantling of demarcation equipment and the issue and cancellation of a **Permit-to-Work Shall** meet the requirements of the **OSR**.

9.7.2 At all times, the appropriate precautions **Shall** be taken to avoid **Danger** from **Conductors** energised at nominal **System** voltage.

9.7.3 Table 9.1, and Figure 9.1, show standard requirements for demarcation under a **Permit-to-Work**.

9.7.4 Where solid coloured cones are not available, it is permitted to utilise a coloured sleeve of the appropriate colour, over a yellow self-supporting cone. In these circumstances the coloured sleeve **Shall** cover at least 75% of the visible area of the cone.

Table 9.1 - Demarcation Requirements for Work Under the Control of a Permit-to-Work

Demarcated Area	Demarcation Requirements
Perimeter Boundary	Yellow cones.
	Yellow and black chain.
Entrance	Zone will have an open entrance, denoted by two purple cones leading to the entrance.
	Access notice to be positioned next to the entrance. Blue text on white background.
Inside the Zone of Work	Green cones.
	Live Conductors over work area notice (if required). Black text on yellow background (additional signs made of a magnetic material for ease of fixing, may also be used).

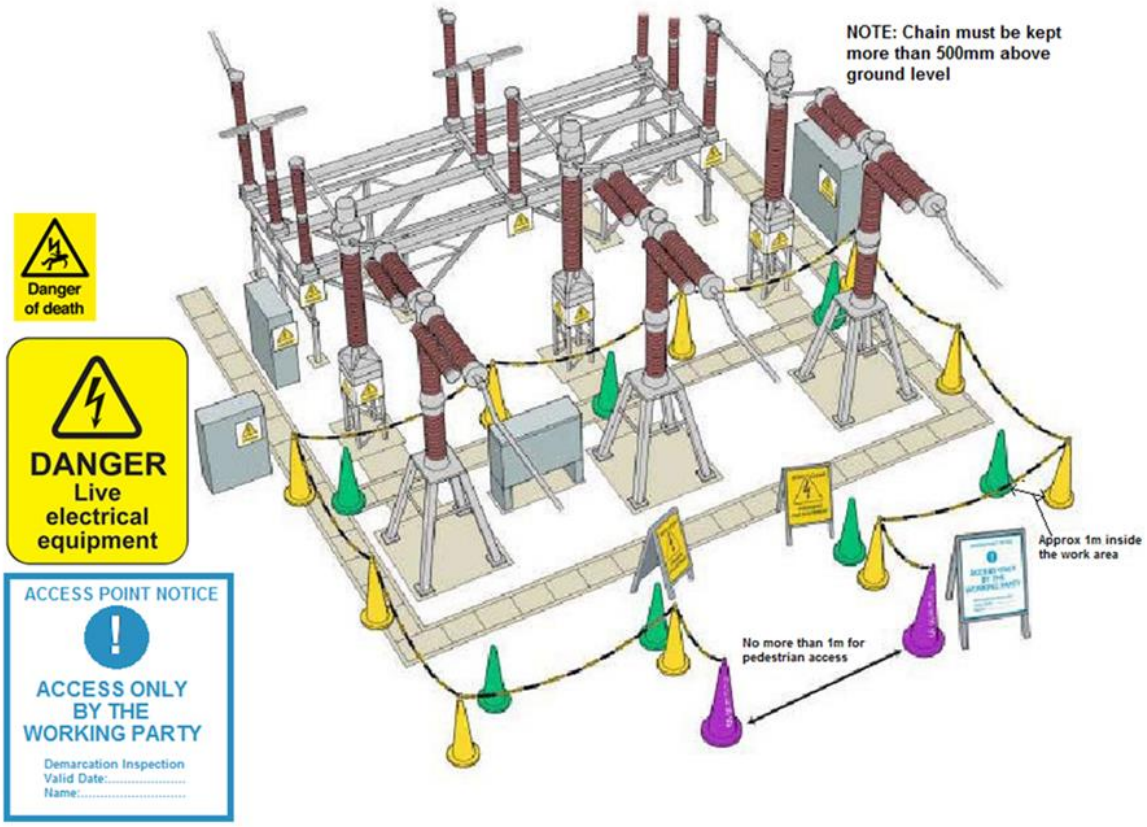

Figure 9.1 - Typical Demarcation for the Control of Work Under a Permit-to-Work

9.7.5 Demarcation **Shall** comprise a single yellow and black closed link plastic chain effectively supported on yellow self-supporting cones, approximately 1.0 metre high. The location of the demarcation chain **Shall** take into account the specified **Working and Access Clearances,** both from ground level and also all working positions. An access gap **Shall** be introduced into the **Demarcated Zone.**

9.7.6 The entrance to the **Demarcated Zone Shall** be shaped using two purple self-supporting cones. This entrance **Shall** not be more than 1.0 metre wide for pedestrian access. For large sites, it **Shall** be permissible to introduce more than one access to a demarcated area. Again, demarcation of each additional entry point to the zone of work **Shall** consist of two purple self-supporting cones.

9.7.7 All entry points Shall be reinforced with an 'Access Point Notice' which **Shall** be positioned immediately adjacent to the entrance so as not to interfere with pedestrian access. Access Point Notices **Shall** be blue text on white background.

9.7.8 The **Senior Authorised Person Shall** be responsible for specifying the location of all access points. Subsequent control of access points **Shall** be the responsibility of the **Safety Document** recipient.

9.7.9 Green self-supporting cones **Shall** be placed at suitable 0.5 to 1.0 metre intervals inside the demarcation chain to clearly distinguish the demarcation area. A self-supporting green cone **Shall** be positioned at every point where there is a change of direction in the demarcation chain. For large **Demarcated Zones**, additional self-supporting green cones may be deployed as necessary.

9.7.10 **Danger Notices Shall** be attached to adjacent **Apparatus** containing **Live Conductors** or adjacent **Conductor** supports at the limits of the zone of work. Where necessary, additional **Danger Notices** may be placed such they are visible from:

- The zone of work and any marked access ways
- All angles of approach to adjacent **Live Conductors** from within the **Demarcated Zone**

9.7.11 'Overhead Live Equipment Notices' **Shall** be posted where over-sailing **High Voltage Conductors** exist.

9.7.12 On completion of the demarcation, the **Senior Authorised Person Shall** satisfy themself that any person in the **Demarcated Zone** will understand and be aware of the **Danger** from the surrounding area containing **Live High Voltage Conductors**.

9.7.13 Where the zone of work comprises the whole of an area within a continuously fenced compound (i.e. no **Live Apparatus** present), there **Shall** be no requirement for demarcation chains. Green self-supporting cones **Shall** be suitably positioned in the fenced compound area so that they are visible from all points of work.

9.7.14 Work in the **Demarcated Zone Shall** commence following a pre-work briefing and inspection of the demarcation equipment to confirm its continuing suitability. The **Senior Authorised Person Shall** brief the recipient of the **Safety Document** on the first day of a given work activity. Recommencement of the work on subsequent days **Shall** be the responsibility of the recipient of the **Safety Document**, who **Shall,** following a pre-work inspection, restart the **Working Party** at the commencement of each day.

9.7.15 The person who has carried out the pre-work inspection and **Approved** the recommencement of work on subsequent days **Shall** update the Access Point Notice particulars.

9.7.16 Where more than one **Permit-to-Work** is in force for one specific **Demarcated Zone**, the recipients of each **Permit-to-Work Shall** communicate directly with each other and mutually agree that one of the recipients **Shall** carry out the pre-work inspection and mark up the Access Point Notice.

9.8 Applied Demarcation when under the Control of a Sanction-for-Test

9.8.1 The erection and dismantling of demarcation equipment and the issue and cancellation of the **Sanction-for-Test Shall** meet the requirements of the **OSR.**

9.8.2 At all times, the appropriate precautions **Shall** be taken to avoid **Danger** from **Conductors** energised at nominal **System** voltage and where appropriate, **Conductors** energised as a consequence of **High Voltage** testing.

9.8.3 Table 9.2, and Figure 9.2 show standard requirements for demarcation under a **Sanction-for-Test**.

Table 9.2 - Demarcation Requirements for Work Under the Control of a Sanction for Test

Demarcated Area	Demarcation Requirements
Perimeter Boundary	Yellow cones.
	Yellow and black chain.
Entrance	Zone will have a closed entrance using a yellow and black chain.
	Zone will be denoted by two purple cones leading to the entrance.
	Access notice to be positioned next to the entrance. Blue text on white background.
Inside the Zone of Work	Yellow cones with red sleeves having white text denoting 'Test Area'.
	Qualified 'No Entry' sign. White text on red background.
	Live Conductors over work area notice (if required). Black text on yellow background (additional signs made of a magnetic material for ease of fixing, may also be used).

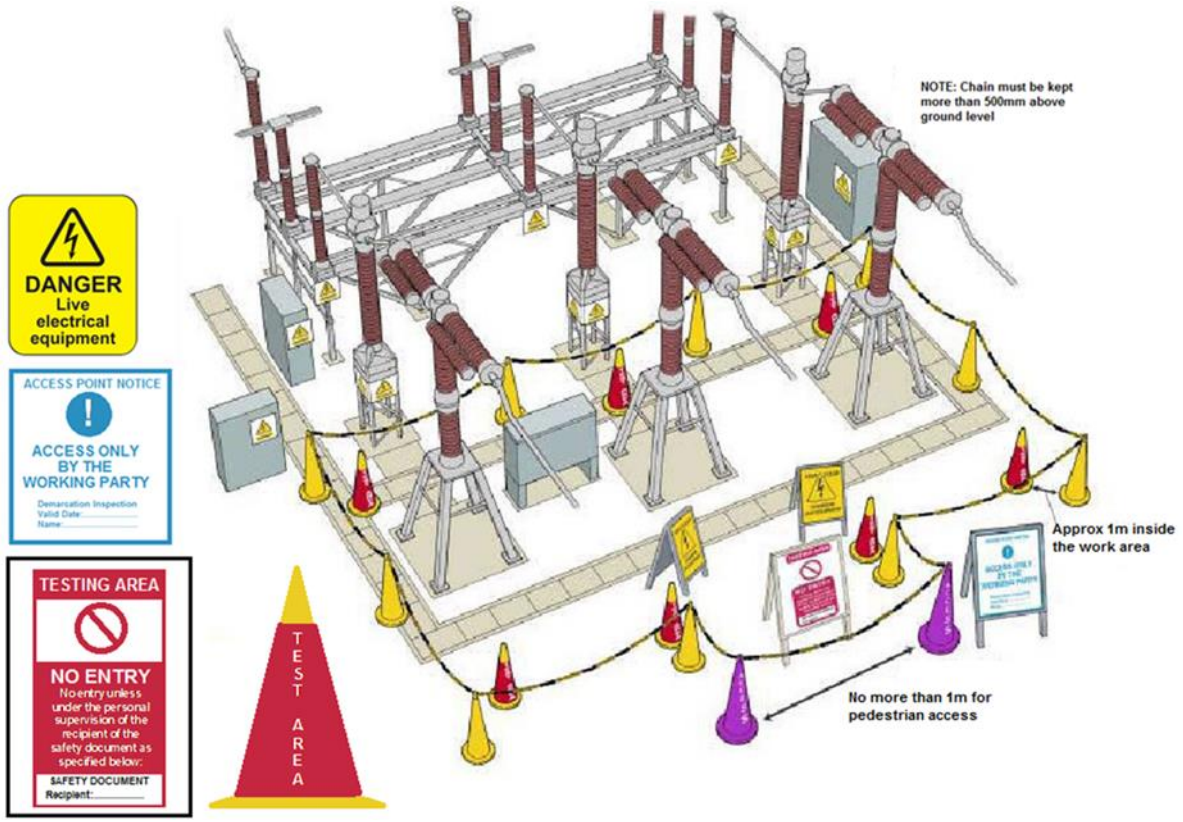

Figure 9.2 - Typical Demarcation for the control of work Under a Sanction for Test

9.8.4 Demarcation **Shall** comprise a single yellow and black closed link plastic chain effectively supported on yellow self-supporting cones, approximately 1.0 metre high. The demarcation chain **Shall** take into account the specified **Working and Access Clearances**, both from ground level and also all testing positions. An access gap, including gate chain, **Shall** be introduced into the **Demarcated Zone**.

9.8.5 The entrance to the **Demarcated Zone Shall** be shaped using two purple self-supporting cones. This entrance **Shall** not be more than 1.0 metre wide for pedestrian access. The **Demarcated Zone** gate chain can be removed and replaced to allow safe access as required. Use of the gate must be strictly controlled by the recipient of the **Safety Document.**

9.8.6 The entrance to the demarcated area **Shall** be reinforced with an 'Access Point Notice' which **Shall** be positioned immediately adjacent to the entrance so as not to interfere with pedestrian access. Access Point Notices **Shall** be blue text on white background.

9.8.7 During testing only one entry gate is permitted. This gate **Shall** be under the **Personal Supervision** of the **Safety Document** recipient in charge of the testing.

9.8.8 'Testing Notices' or self-supporting 'Test Cones' **Shall** be placed at suitable 0.5 to 1.0 metre intervals inside the demarcation chain to clearly distinguish the demarcation area. A Testing Notice or self-supporting Test Cone **Shall** be positioned at every point where there is a change of direction in the demarcation chain. For large **Demarcated Zones** additional Testing Notices or self-supporting Test Cones may be deployed as necessary.

9.8.9 **Danger Notices Shall** be attached to adjacent **Apparatus** containing **Live Conductors** or adjacent **Conductor** supports at the limits of the zone of work. Where necessary, additional **Danger Notices** may be placed such that they are visible from:

- The zone of work and any marked access ways
- All angles of approach to adjacent **Live Conductors** from within the **Demarcated Zone**

9.8.10 'Overhead Live Equipment Notices' **Shall** be posted where over sailing **High Voltage Conductors** exist.

9.8.11 On completion of the demarcation, the **Senior Authorised Person Shall** satisfy themself that anyone in the **Demarcated Zone** can understand and be aware of the **Danger** from the surrounding area containing **Live High Voltage Conductors** and from within the testing zone.

9.8.12 Where the testing zone comprises the whole of an area within a continuously fenced compound (i.e. no **Live Apparatus** present), there **Shall** be no requirement for demarcation chains. Testing Notices or self-supporting Test Cones **Shall** be suitably positioned in the fenced compound area so that they are visible from all points of testing.

9.8.13 Testing **Shall** commence following a pre-work inspection of the demarcation equipment to confirm its continuing suitability. The **Senior Authorised Person Shall** brief the recipient of the **Sanction for Test** on the first day of a given testing activity. Recommencement of the testing on subsequent days **Shall** be the responsibility of the recipient of the **Sanction for Test**, who **Shall,** following a pre-work inspection, restart the testing at the commencement of each day.

9.9 Applied Demarcation when under the Control of a Limitation-of-Access

9.9.1 It **Shall** be the responsibility of the **Senior Authorised Person** to determine whether demarcation is required for work carried out under a **Limitation-of-Access**.

9.9.2 Where it has been established that demarcation equipment is required, this equipment **Shall** differ from that used for creating a safe zone of work under other non-related **Safety Documents**.

9.9.3 For work under the control of a **Limitation-of-Access**, demarcation equipment **Shall** consist red and white barrier systems or Heras type fencing which will create a physical barrier.

9.9.4 The entrance to the demarcated area **Shall** be an opening not more than 1.0 metre wide for pedestrian access.

9.9.5 Where appropriate, **Danger Notices Shall** be attached to both the **High Voltage Apparatus** to be worked on and any adjacent **High Voltage** equipment.

9.9.6 The erection and dismantling of demarcation equipment and the issue and cancellation of a **Limitation-of-Access Shall** meet the requirements of the **OSR**.

9.9.7 At all times, the appropriate precautions **Shall** be taken to avoid **Danger** from **Conductors** energised at nominal **System** voltage.

9.9.8 Table 9.3 and Figure 9.3 show standard requirements for demarcation under a **Limitation-of-Access**.

Table 9.3 - Demarcation Requirements for Work Under the Control of a Limitation-of-Access

Demarcated Area	Demarcation Requirements
Perimeter Boundary	At the **Senior Authorised Person's** discretion.
	Where applicable, Red and white demarcation or barrier system used.
	Heras type fencing may be used as a more appropriate physical barrier where required. (see NOTE)
Entrance	Zone will have an open entrance.
Inside the Zone of Work	At the **Senior Authorised Person's** discretion.

NOTE: The Installation of any substantial barrier/fence Shall not compromise the height of the statutory compound fence.

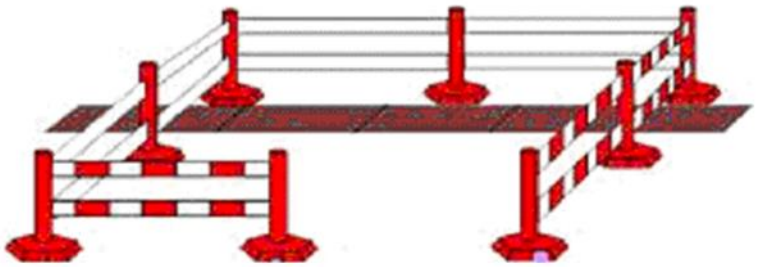

Figure 9.3 - Typical Demarcation for the control of Work Under a Limitation-of-Access

9.9.9 The use of a **Limitation-of-Access** in open compound substations with exposed **Live Conductors** generally applies to work at ground level, for example work on equipment at **Earth** potential and non-electrical civil works. Safety **Shall** be achieved by maintaining the appropriate **Safety Distance** from exposed **Live Conductors**. Owing to the nature of the work and safety controls required, this safety clearance is typically much greater than the **Working and Access Clearances** defined in the **OSR**.

9.9.10 Activities such as vegetation management (e.g. weed killing) inside substation compounds and draining of transformer bunds are routine ground level activities and do not require the issue of a **Safety Document**, provided the person carrying out the work:

- Holds a current Competency for the required activity
- Holds a current and appropriate authorisation category for entering substations containing exposed **Live Conductors**
- Completes an on-site risk assessment

NOTE: Vegetation management near **Live Apparatus** and **Conductors Shall** meet the requirements of ENA ER G136.

9.10 Additional Demarcation Requirements for GIS Substations

9.10.1 Additional to the preceding sections, the following safety precautions **Shall** be applied to Gas Insulated Switchgear (GIS) **Apparatus**.

9.10.2 Self-fixing boundary markers **Shall** be positioned around a gas barrier. The boundary marker **Shall** have a segment of red stripes indicating the **Danger** side and green arrows indicating the safety side of the gas barrier. These segments **Shall** be separated by a single white stripe.

9.10.3 This type of boundary markers **Shall** be applied following the reduction of gas pressure on the **Danger** side of the **Plant**. The reduction of gas pressure **Shall** be carried out in compliance with PR-NET-SST-009.

9.10.4 'Vented Gas Zone Access Point Notices' **Shall** be attached to all gas zones that have been vented and therefore made safe for work activities.

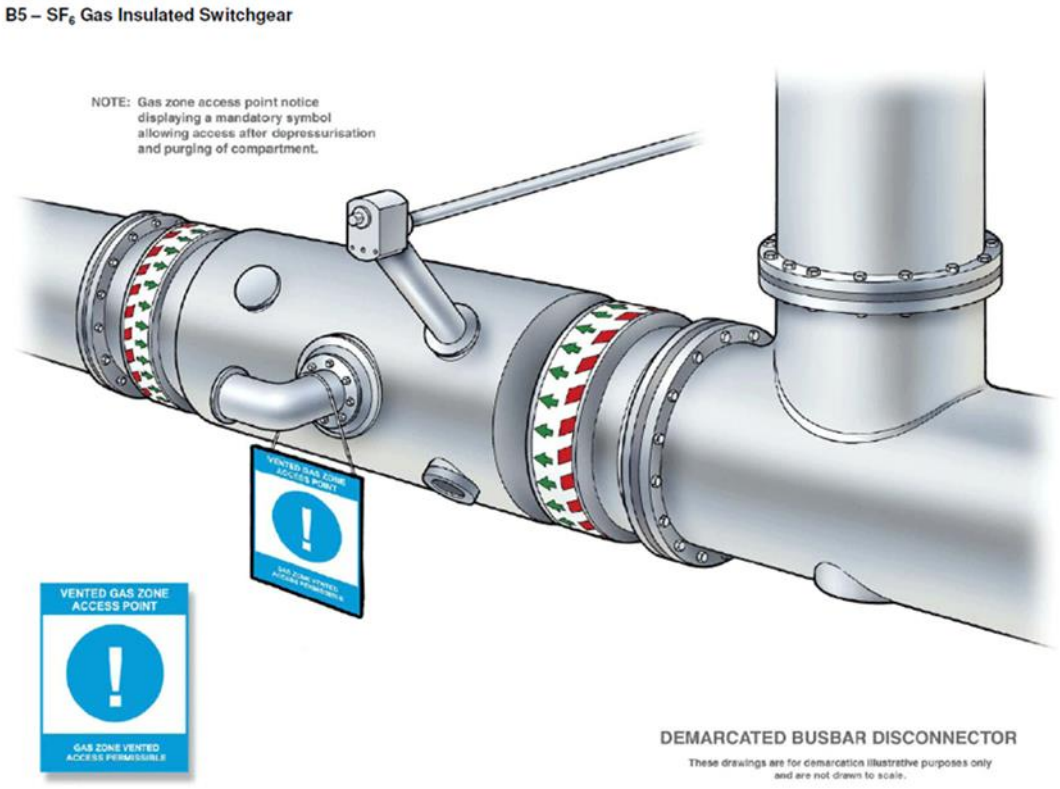

Figure 9.4 - Typical Use of Mandatory Self-fixing Boundary Markers

9.11 Movement and Use of Portable Ladders and Long Objects in Demarcated Zones

9.11.1 The use of portable ladders and **Long Objects** where there are exposed **Live High Voltage Conductors Shall** be in accordance with Section 4.5.4 of the **OSR.**

9.11.2 Persons undertaking such activities **Shall** be trained and hold the appropriate competency level for the movement of portable ladders, **Long Objects**, cranes and scaffold in open compounds containing **Live High Voltage Apparatus**.

9.11.3 Portable ladders and scaffolding **Shall** be of an **Approved** type. Generally, this requires such tools to be manufactured from non-conductive materials. Portable ladders and scaffolding **Shall** be of an appropriate size/length for the work to be undertaken.

9.11.4 Where the use of non-conductive portable ladders and scaffolding cannot be achieved, any portable ladder or scaffolding erected adjacent to exposed **Live High Voltage Conductors Shall** be connected to the substation **Earthing System** via **Approved** means.

9.11.5 Particularly for scaffolding, consideration **Shall** be given to the size of the scaffold structure and the need for adequate **Earth** bonds. As erection proceeds, the scaffolding **Shall** be electrically bonded to **Earth**. Typically, this will be at approximately 5m intervals, vertically and horizontally, or as determined by the **Senior Authorised Person**.

9.11.6 Where separate **Earthing Systems** exist, these **Shall** not be connected together. Precautions **Shall** be taken to avoid **Danger** from the reduced separation between individual **Earthing Systems**. It might therefore be necessary to install a non-conductive panel between a temporary **Earthed** scaffold and the permanent substation fence.

9.11.7 When not in use, portable ladders and **Long Objects Shall** be stored in accordance with the manufacturer's instruction and be securely locked to a suitable anchorage.

9.11.8 Portable ladders and **Long Objects Shall** not be used in substations containing exposed **High Voltage** busbars without the permission of a **Senior Authorised Person**. Any subsequent movement **Shall** be agreed by the **Authorised Person** in charge of the work.

9.11.9 Portable ladders and **Long Objects** (such as scaffolding) **Shall** be checked for damage before use. Portable ladders and scaffolding **Shall** be fitted with ladder-tags and scaff-tags, the details of which **Shall** be verified as part of the pre-use inspection. Any portable ladder or **Long Object** found unsafe/not fit for purpose **Shall** be withdrawn from use immediately, quarantined and marked-up accordingly.

9.11.10 Before moving portable ladders or **Long Objects**, manual handling techniques and weight distribution **Shall** be considered. Where practicable, movement of such items **Shall** be carried out by two persons.

9.11.11 The movement, erection and dismantling of portable ladders and **Long Objects Shall** be carried out under the **Personal Supervision** of the **Authorised Person** in charge of the work. When moved at ground level, ladders and **Long Objects Shall** be carried in the horizontal position and as near to the ground as is practicable.

9.12 Movement of Cranes, Vehicles and Mobile Equipment in Demarcated Zones

9.12.1 The use of cranes, vehicles and mobile equipment (inc MEWPs) where there are exposed **Live High Voltage Conductors Shall** be in accordance with Section 4.5.5 of the **OSR**.

9.12.2 Persons undertaking such activities **Shall** be trained and hold an appropriate competency level for the activity. Where necessary, formal lifting plans or similar activity specific plans **Shall** be produced and made available to the **SAP** providing permission for the activity to take place.

9.12.3 All access routes associated with the on-site movement of cranes, vehicles and mobile equipment (inc MEWPs) **Shall** be defined by a **Senior Authorised Person** who **Shall** notify the operators of the hazards of working near **Live High Voltage Apparatus**. At no time **Shall Safety Distance** be infringed.

9.12.4 Consideration **Shall** be given to the use of a standby person to avoid **Danger** and the means by which the standby person is able to communicate with operators of cranes, vehicles and mobile access equipment. Where a standby person is used, the means by which halting the movement of mobile equipment **Shall** be agreed in advance.

9.12.5 The on-site movement of cranes, vehicles and mobile access equipment higher than 2.3m above ground level, including any load or fully extended radio or other aerials, **Shall** be under the **Personal Supervision** of the **Safety Document** recipient.

9.12.6 Consideration **Shall** be given to the **Danger** from induced voltages. Physical contact **Shall** not be made by persons on the ground with any crane, vehicle or access equipment when it is moving under or being operated adjacent to live **High Voltage Conductors**.

9.12.7 As soon as is practicable after reaching the work area, cranes, vehicles and mobile access equipment **Shall** be connected to the substation **Earthing System** via **Approved** means.

10 Revision History

No	Overview of Amendments	Previous Document	Revision	Authorisation
01	Transferred to new template and nomenclature	PR-PS-541	1.00	David Colthart
02	New template version created	PR-NET-OSM-011 (Rev1.00)	2.00	Richard Gough
03				

Appendix A Risk Assessment for Work in Substations with Exposed High Voltage Conductors

This risk assessment **Shall** be completed before work is started on or near **Apparatus** in substations with exposed busbars and / or connections.

Location	
Safety Document holder	
Permit-to-Work ref No	
SFT ref No	
Limitation-of-Access ref No	

Does the proposed task involve using cranes, vehicles, mobile plant or scaffolding in the vicinity of, or that could possibly come in the vicinity of Live Conductors?		**Yes/No**
If yes, then	1. The route / access through to the work position and back out of the substation **Shall** be agreed with a Senior Authorised Person. 2. The crane and / or other equipment **Shall** only be moved on the agreed route under the **Personal Supervision** of an **Authorised Person** and **Shall** be connected to the substation **Earthing System** as soon as practicable.	
Does the proposed task involve transporting and / or use Long Objects and / or portable ladders in the substation?		**Yes/No**
If yes, then	1. The movement and use of such **Long Objects** must be agreed with the **Senior Authorised Person** and carried out under the **Personal Supervision** of the **Authorised Person**. These items **Shall** be moved in a horizontal position near to the ground.	
Does the proposed task involve staff working above ground level?		**Yes/No**
If yes, then	1. **Working And Access Clearances Shall** be maintained from the nearest exposed **Live High Voltage Conductors** at all times. The climbing of structures to gain access is forbidden. Portable ladders used to gain access to fixed ladders terminating above ground level **Shall** be locked in position or otherwise secured. 2. **Adequate Working And Access Clearances** must be maintained during the construction of any working platform as well as during the subsequent execution of the works from that platform. 3. Where limited space is available a “Caution Exclusion Zone Men working above” sign will be affixed to the Green or Red (test area) cone adjacent to the purple access cones. The yellow/ black chain will then have the dual purpose of acting as the “exclusion zone” as well as the de-limiting area. If there is sufficient space available within the de-limited area, section 3 of TG-NET-OHL-002 Exclusion Zones - Working at Height - Safety Instruction **Shall** be the **Approved** method of defining the “exclusion zone” for the structure being worked on.	
Does the proposed task involve working on, or disturbing, phase Conductors to which Earths are connected?		**Yes/No**
If yes, then	1. Reconsider the proposed position of the **CME**s or **Additional Earths** so that they are not disturbed. 2. Agree temporary or permanent dismantlement of **CME**s with the **Control Engineer**, cancelling **Permit-to-Work** first if one is in force. 3. Use **Additional Earths** as required to connect all **Conductors** to **Earth**.	
Does the proposed task involve dismantling Apparatus to which Circuit Main Earths are connected?		**Yes/No**
If yes, then	1. Reconsider the proposed position of the **CME**s so that they are not disconnected from the **Apparatus** until the **Permit-to-Work** can be cancelled. 2. Leave dismantlement until after all other works finished. 3. Agree temporary or permanent dismantlement of **CME**s with the **Control Engineer**, cancelling **Permit-to-Work** first if one is in force.	

Will the proposed application of Earths result in the Earth end clamp connection being connected to an item of Apparatus inside the zone of work?		**Yes / No**
If yes, then	1. Locate the **Earth** end clamp so that it is outside the zone of works wherever reasonably practicable. 2. Record the position of any such **Earth** clamp on the **Safety Document** and all staff are to be fully briefed on its position and any precautions to be taken.	
Does the proposed task involve the installation of overhead Conductors or busbars, which could require the application of Additional Earths?		**Yes / No**
If yes, then	1. Apply **Additional Earths** as soon as reasonably practicable.	
Is the integrity of the substation earthing in any way defective? (Check for damage and omissions due to vandalism or theft?)		**Yes / No**
If yes, then	1. Carry out repairs before commencing work. 2. These repairs will be subject to their own risk assessment.	
Does the proposed task involve any work on the substation Earth system which involves breaking any connection with that system?		**Yes / No**
If yes, then	1. Consider whether the work can be completed in a manner that avoids this. 2. Install parallel **Earth** connections before disconnections are carried out.	
Is there a risk from induced voltages being generated within the zone of work, or by overhead lines and cables outside the zone of work which are connected to the equipment to be worked on? (include standing voltages, faults and lightning)		**Yes / No**
If yes, then	1. Consider disconnecting incoming overhead line / cable at terminal position. 2. Consider **Switching** out circuit which is source of induction. 3. Erect more **Additional Earths**.	
Does the work involve more than one Working Party?		**Yes / No**
If yes, then	1. Prepare a method statement describing what work is to be carried out at each stage of the job, which **Safety Documents** will be applied and how a safe working environment will be maintained. 2. Arrange a site safety meeting for all staff who will be involved in the job at any stage.	
With the demarcation arrangements in place, is there any risk that the proposed works could infringe the Working And Access Clearances of any Live exposed Conductors?		**Yes / No**
If yes, then	1. Redesign the work method to ensure that **Working And Access Clearances** are not infringed. 2 Where necessary, reconsider the points of isolation to extend the safe zone around the working area in order to provide and maintain adequate **Working And Access Clearances**.	
Assessed by: **Date** / /		

Site Method Statements	

Appendix B Demarcation Equipment Summary

Item	Note (see KEY)	Suggested Amount	Stock No.
Yellow cone	1	25	
Purple cone	2	2	
Yellow/black plastic chain (m)	3	65	
Green sleeve	4	8	
Red sleeves (TEST AREA)	5	8	
Purple sleeves (ACCESS POINT)	6	2	
Red and white sleeve (HAZARD)	7	1	
Road cones (red and white)	8	10	
Cone mounted yellow notice (LIVE CONDUCTORS OVER WORK AREA)	9	2	
Cone mounted blue notice (ACCESS POINT)	10	1	
Cone mounted red notice (TESTING AREA)	11	1	
Magnetic yellow/blue notice (DANGER Treat as Live)	12	6	
Magnetic red/yellow notice (DANGER DO NOT CLIMB/LIVE CONDUCTORS OVER WORK AREA)	13	6	

KEY

Cones and sleeves

NOTE 1. Yellow plastic cones preferably between 1000mm and 1200mm high, slotted and acting as independent supports for the chain.

NOTE 2. Purple plastic cones preferably between 1000mm and 1200mm high, slotted and acting as independent supports for the chain.

NOTE 3. Yellow and black plastic chain 25 metre length x 6mm gauge with closed links to fit in slots in cone tops.

NOTE 4. Plain green sleeve preferably 1000mm high from the base of the cone.

NOTE 5. Red sleeve preferably 1000mm high from the base of the cone with white text stating 'TEST AREA' printed with the letters arranged vertically one above the other.

NOTE 6. Purple sleeve preferably 1000mm high from the base of the cone with black text stating 'ACCESS ROUTE' printed with the letters arranged vertically one above the other.

NOTE 7. Red and white banded sleeve preferably 1000mm high from the base of the cone with black text stating 'HAZARD' printed with the letters arranged vertically one above the other.

NOTE 8. Road cones to the requirements of the New Roads and Streetworks Act (NRSWA).

Cone mounted notices

NOTE 9. Cone mounted dual face warning notice with black lettering on a yellow background stating 'LIVE CONDUCTORS OVER WORK AREA'. Black thunderbolt symbol enclosed in a black triangle immediately above main lettering.

NOTE 10. Cone mounted single face mandatory notice with blue text on a white background stating '**ACCESS POINT NOTICE. ACCESS ONLY BY THE WORKING PARTY. NO PERSON SHALL ENTER THIS WORK ZONE, WHILST WORK IS TAKING PLACE, UNTIL THEY HAVE MADE CONTACT WITH THE SAFETY DOCUMENT HOLDER AND BEEN FULLY INDUCTED INTO THE WORK. SAFETY DOCUMENT HOLDER. CONTACT DETAILS'**. Provision for **Safety Document** holder and contact details immediately below main lettering.

NOTE 11. Cone mounted single face prohibition notice with white text on red background stating '**TESTING AREA. NO ENTRY WITHOUT THE PERMISSION OF THE SAFETY DOCUMENT HOLDER AS IDENTIFIED BELOW. SAFETY DOCUMENT HOLDER. CONTACT DETAILS'**. Provision for **Safety Document** holder and contact details immediately below main lettering.

NOTE 12. Magnetic single face multi-message notice showing a warning image (yellow on white background) and mandatory image (blue on white background). Applications include attachment to steel cabinets and steel structures

NOTE 13. Magnetic single face multi-message notice showing a warning image (black lettering on yellow background) and prohibition image (white lettering on a red background with a crossed red circle).

Warning text states, '**LIVE CONDUCTORS OVERHEAD - WORK AREA'** Black thunderbolt symbol enclosed in a black triangle in between main lettering.

Prohibition text states '**DANGER DO NOT CLIMB'**